Chaudhary Bansi Lal University

(A State University established under Haryana Act No. 25 of 2014)

Scheme of Examination
for
Physics Subject
in
Undergraduate Programmes

as per NEP 2020

Curriculum and Credit Framework for Undergraduate Programmes (Multiple Entry-Exit, Internships and Choice Based Credit System LOCF)

With effect from the session 2024-25 (in phased manner)

DEPARTMENT OF PHYSICS

Chaudhary Bansi Lal University, Prem Nagar-127021
Bhiwani
HARYANA, INDIA

Chaudhary Bansi Lal University Bhiwani

Scheme of Examination for the Physics Subject in Under Graduate Programmes

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(Multiple Entry-Exit, Internships and Choice Based Credit System LOCF) with effect from the session 2024-25 (in a phased manner)

Semester-III

Course Type	Applicable Scheme	Course Code	Nomenclature of paper	Credits	Contact hours	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs.) T+P
CC-3/ MCC-4	A,B&C	24UN-PHY-301	Thermodynamics & Statistical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-2	B	24UN-PHY -102	Mathematical Physics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MCC-5	B &C	24UN-PHY -302	Classical Mechanics	3	3	20	50	70	3
			Practicum	1	2	10	20	30	3
MDC3	A,B & C	From Available pool of Multidisciplinary Courses as per NEP							
CC-M3	A & C	From Available CC-3/MCC-4 of 4 credits as per NEP							
CC-M3 (V)	B	From Available pool of Minor (Vocational) CoursesVOC-3							
AEC-3	A,B&C	From Available pool of Ability Enhancement Courses as per NEP							
SEC-3	A,B&C	From Available pool of Skill Enhancement Courses as per NEP							
VAC-3	C	From Available pool of Value Added Courses as per NEP							

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: CC-3/MCC-4

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3rd		
Name of the Course	**Thermodynamics & Statistical Physics**		
Course Code	24UN-PHY-301		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	Appeared or passed the 2nd sem(B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand and describe the basic concepts and laws of thermodynamics 2. Apply the laws of thermodynamics to develop Maxwell's thermodynamic relations be able to understand their physical interpretations 3. Appreciate cellular nature of phase space and Have better knowledge of classical statistics which would result in greater insight into solutions of various complex problems 4. Have better understanding of quantum statistics and are in a position to extend the treatment to the analysis of complex problems 5. Learn to present observations, results, analysis and different concepts of experiments related to Thermodynamics & Statistical Physics		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5

Max. Marks:100 **Internal Assessment Marks:30** **End Term Exam Marks: 70**	**Time:3hrs**

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.

2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.

3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.

4. 20% numerical problems are to be set.

5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Thermodynamics-I** Thermodynamic-systems, variables and equation of state, thermal equilibrium, Zeroth law of thermodynamics; Concept of heat and work, First law of thermodynamics- its significance and limitations, internal energy as a state function, different types of process-isochoric process, isobaric process, adiabatic process, isothermal process, cyclic process, Reversible and irreversible process, First law and cyclic process; Second law of thermodynamics and its significance, Carnot theorem; Joule's free expansion, Joule Thomson effect, Joule-Thomson (Porous plug) experiment : conclusions and explanation, Entropy, calculations of entropy of reversible and irreversible process, T-S diagram, entropy of a perfect gas, Nernst heat law (third law of thermodynamics); Liquefaction of gases (qualitative idea).	11
II	**Thermodynamics-II** Derivation of Clausius-Clapeyron and Clausius latent heat equations and their significance, phase diagram and triple point of a substance, development of Maxwell thermo dynamical relations, Thermodynamical functions: Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) and the relations between them, derivation of Maxwell thermodynamical relations from thermodynamical functions, Application of Maxwell relations: relations between two specific heats of gas, derivation of Stefan's law, adiabatic compression and expansion of gas & deduction of theory of Joule Thomson effect.	10
III	**Statistical Physics-I**	12

	Distribution of N (for N= 2, 3, 4) distinguishable and indistinguishable particles in two boxes of equal size, microstates and macrostates, thermodynamical probability, constraints and accessible states, statistical fluctuations, general distribution of distinguishable particles in compartments of different sizes, β-parameter, entropy and probability; Concept of phase space, division of phase space into cells, postulates of statistical mechanics; Classical and quantum statistics, basic approach to these statistics, Maxwell-Boltzmann statistics applied to an ideal gas in equilibrium-energy distribution law, Maxwell's distribution of speed & velocity (derivation required), most probable speed, average and r.m.s. speed, mean energy for Maxwellian distribution.	
IV	**Statistical Physics-II** Dulong and Petit Law, derivation of Dulong and Petit law from classical physics; Need of Quantum statistics- classical versus quantum statistics, Bose-Einstein energy distribution Law, Application of B. E. Statistics to Planck's radiation law, degeneracy and B. E. condensation; Fermi-Dirac energy distribution Law, F.D. gas and degeneracy, Fermi energy and Fermi temperature; F. D. energy distribution Law for electron gas in metals, zero point energy, average speed (at 0 K) of electron gas	11
	<u>Practicum</u> 1. To determine Mechanical Equivalent of Heat, by Callender and Barne's constant flow method. 2. Measurement of Planck's constant using black body radiation. 3. To determine Stefan's Constant. 4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus. 5. To determine the Coefficient of Thermal Conductivity of Cuby Angstrom's Method. 6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method. 7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer. 8. To study the variation of thermo emf across two junctions of a thermocouple with temperature. 9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system 10. To calibrate Resistance Temperature Device(RTD) using Null Method/Off-Balance Bridge 11. To prove the law of probability by using one coin, two coins and10 or more coins. 12. To determine the coefficient of increase of volume of air at constant pressure. 13. To determine the coefficient of increase of pressure of air at constant volume.	30

	Computer simulation of Maxwell-Boltzmann distribution, Fermi-Dirac & Bose-Einstein 15. Study of statistical distribution from the given data and to find most probable, average, and rms value 16. Mechanical Equivalent of heat(J) by Joule's calorimeter. 17. Heating efficiency of electrical kettle with varying voltage. **Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.**	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory(20Marks)** • Class Participation: **05 Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05 Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation :**Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam: **Nil**	**End Term Examination :50 Marks** **20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Thermal Physics and Statistical Mechanics, S.K. Roy, New Age International Publishers, New Delhi
2. Thermodynamics and Statistical Physics, J.K. Sharma and K.K. Sarkar, Himalaya Publishing House, Bombay
3. Introduction to Thermodynamics and its Applications, Stowe Keith, University Press (India) Pvt. Ltd, Hyderabad
4. Introductory Thermodynamics, Pierre Infelta, Brown Walker Press, Boca Ratan,Florida
5. Fundamentals of Thermodynamics, J.K. Johnson, University of Pittsburgh 2009
6. Thermodynamics and Its Applications,JeffersonTester,MichaelModell,3rdEdition
7. Thermodynamics, Statistical Thermodynamics & Kinetics, Thomas Engel, PhilipReid,2nd Edition
8. Advanced Practical Physics for students, B.L. Flint &H.T.Worsnop,1971, Asia Publishing House.
9. Advanced level Physics Practical's, Michael Nelson and Jon M.Ogborn,4th Edition, reprinted 1985, Heinemann Educational Publishers
10. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
11. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985,Vani Publication.

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: MCC-2

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3rd		
Name of the Course	**Mathematical Physics**		
Course Code	24UN-PHY-102		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course(Asper Annexure-I	100-199		
Pre-requisite for the course(if any)	Appeared or passed the 2nd sem (B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn the Fourier analysis of periodic functions and their applications in physical problems. Learn the beta, gamma and the error functions and their applications in doing integrations. 2. Acquire knowledge of methods to solve partial differential equations with the examples of important partial differential equations in Physics. 3. Write given function in terms of sine and cosine terms in Fourier series and also to get knowledge in Fourier transforms 4. Learn about beta gamma function, their properties, solve Legendre equations find generating function for Legendre Polynomial, Hermite equation, study orthogonal properties of Hermite Polynomials, recurrence relations of complex numbers and their properties such as analyticity, poles and residues. 5. Learn about the methods to solve the mathematical problem using Fortran		
Credits	Theory	Practical	Total
	3	1	4

Contact Hours	3	2	5
Max. Marks:100 **Internal Assessment Marks:30** **End Term Exam Marks: 70**		**Time:3hrs**	

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Theory of Errors:** Systematic and Random errors, Propagation of errors, Normal law of errors, Standard and Probable error, Least square fit, error on slope and intercept of fitted line. **Matrices:** Normal Matrices, Orthogonal Matrices, Hermitian Matrices, Unitary Matrices, Symmetric and Anti-symmetric Matrices, Conjugate of a Matrix, Anti-hermition Matrices, Trace of Matrix, Eigen values and eigen vectors of Matrices, Diagonalization of Matrices.	11
II	**Method of expansion of a function:** Taylor's expansion, Power series, Laurent's theorem. Partial and ordinary differential equations, Partial Differential equations, First order differential equations, Method of separation of variables, Singular points, Vibrations of an elastic string, One dimensional Heat Flow, Heat conduction equation for a 3-dimensional rectangular configuration and apply it to the cooling of a brick (assuming constant initial temperature distribution), vibrations of rectangular and circular membrane, Method of Frobenius, Diffusion equation, Laplace's equation in problems of rectangular , cylindrical and spherical symmetry, Inhomogeneous partial differential equation-Green's function.	12
III	**Fourier series and Integrals:** Introduction, Evaluation of coefficients of Fourier series, cosine series, sine series, Dirichlet's theorem, representation of Even and odd functions, Extension of interval, complex form of Fourier series, Properties of Fourier series: Convergence, Integration, Differentiation, Parseval's theorem, Physical applications of Fourier series analysis: square wave, Half wave rectifier, Full wave rectifier, saw tooth wave, triangular wave, Fourier Integrals, deduction of expressions for the Fourier Transform and its inverse.	11
IV	**Beta and Gamma Functions:** Definition of gamma function, beta function, other forms of beta function,	11

	Relationship between beta and gamma function, Legendre's equation, Legendre's Polynomial, Legendre's function of second kind, General solution of Legendre's equation, Generating function of Legendre's polynomial, orthogonality of Legendre's polynomials, Deduction of Rodrigue's formula for the Legendre's Polynomials, Hermite Polynomial, Hermite differential equation, Generating function of Hermite Polynomial, deduction of recursion relation for $H_n$of 1^{st}kind and 2^{nd}	
	Practicum **Review of FORTRAN Programming fundamentals:** FORTRAN Preliminaries: Integer and floating point arithmetic expression, built in functions, executable and non-executable statements, input and output statements, Formats, IF, DO and GO TO statements, Dimension arrays, statement function and function subprogram. 1. To print out all natural (even/odd) numbers between given limits using computer. 2. Compute the product of two matrices of different dimension using DO loop 3. Numerical integration by Simpson 1/3 rule 4. Fitting of a straight line using Least-Square method 5. Using array variable, find out the average and standard deviation 6. Write a program to evaluate the function Y=1/[C(1+eCosθ)] and V=√ [C M G (e2 + e Cos θ + 1)], e = 1.1, C = 3.0(E+08), M=5.893(E+24), G=6.67(E-11) for varying value of θ from 0 to π. 7. To find maximum, minimum and range of a given set of numbers using computer. 8. To evaluate sum of finite series. 9. Find the roots of a quadratic equation. 10. To find integration of a definite integral by trapezoidal rule. 11. To find the area of a triangle, sphere and cylinder. 12. Given values for a,b,c and d and a set of values for the variable x evaluate the function defined by. $f(x) = ax^2 + bx + c$ if $x<d$ $f(x) = 0$ if $x=d$ $f(x) = ax^2 + bx - c$ if $x> d$ For each value of x and print the value of x and f(x). Write a program for an arbitrary number of x values. **Note: Teachers will discuss the fundamentals of FORTRAN Programming to the students. There after student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.**	30
Suggested Evaluation Methods		

Internal Assessment:	End Term Examination
➢ **Theory(20Marks)** • Class Participation: **05Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10Marks** • Mid-Term Exam: **Nil**	**:50Marks** **20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Mathematical Methods for Physicists: Arfken, Weber , Harris, Elsevier (2005)
2. Fourier Analysis by M.R. Spiegel, Tata McGraw-Hill (2004)
3. Mathematics for Physicists, Susan M. Lea, Thomson Brooks/Cole (2004)
4. An Introduction to Ordinary Differential Equations, Earl A Coddington, PHI Learning (1961)
5. Differential Equations, George F. Simmons, Tata McGraw-Hill (2006)
6. Essential Mathematical Methods, K.F. Riley and M.P. Hobson, Cambridge University Press (2011)
7. Partial Differential Equations for Scientists and Engineers, S .J. Farlow, Dover Publications (1993)
8. Mathematical methods for Scientists and Engineers, D.A. Mc Quarrie, Viva Books (2003)
9. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House (1971)
10. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn,4th Edition, Heinemann Educational Publishers (1985)
11. A Text Book of Practical Physics, I. Prakash &Ramakrishna,11th Edn,2011, Kitab Mahal (2011)
12. Engineering Practical Physics, S. Panigrahi & B. Mallick, Cengage Learning India Pvt. Ltd (2015)
13. Practical Physics, G.L. Squires, 4thEdition, Cambridge University Press (2015)
14. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal ,Vani Publication (1985)
15. Introduction to Numerical Analysis, S.S.Sastry, 5th Edn., PHI Learning Pvt. Ltd (2012)
16. Schaum's Outline of Programming with C++, J. Hubbard,2000, McGraw-Hill Pub (2000)
17. Numerical Recipes in C: The Artof Scientific Computing,W.H. Pressetal,3rd Edn.,2007, Cambridge University Press (2007)
18. A first course in Numerical Methods, U.M. Ascher & C. Greif,2012,PHILearning (2012)
19. Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn, Wiley India Edition (2007).
20. Numerical Methods for Scientists & Engineers, R.W. Hamming, Courier Dover Publications (1973)
21. An Introduction to Computational Physics, T. Pang, 2nd Edn., Cambridge Univ. Press (2006)
22. Computational Physics, Darren Walker,1st Edn.,2015,Scientific International Pvt. Ltd (2015)

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: MCC-5

Session:2024-25			
Part A-Introduction			
Subject	Physics		
Semester	3rd		
Name of the Course	**Classical Mechanics**		
Course Code	24UN-PHY-302		
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	MCC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course(if any)	Appeared or passed the 2nd sem (B.Sc. Physical Science/ equivalent)		
Course Learning Outcomes(CLO):	After completing this course ,the learner will be able to: 1. Learn the concept of conservation of energy, momentum, angular momentum and apply them to understand the basic problems in physics. 2. Understand the importance of Lagrangian & Hamiltonian dynamics and to find the Lagrangian and Hamiltonian for various simple mechanical systems such as Linear Harmonic oscillator, Simple pendulum, Atwood's machine 3. Describe and understand the concepts of central force motion, Kepler's laws of planetary motion and scattering in central force field 4. Differentiate between inertial and Non-inertial frame of references and describe how fictitious forces arise in a non-inertial frame and to understand the importance of these forces. 5. Learn to present observations, results, analysis and different concepts related to experiments of Classical Mechanics.		
Credits	Theory	Practical	Total
	3	1	4

Contact Hours	3	2	5
Max. Marks:100 **InternalAssessmentMarks:30 End** **Term Exam Marks: 70**		**Time:3 hrs**	

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.

2. Question no. 1will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.

3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.

4. 20% numerical problems are to be set.

1. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**Introductory Ideas of Classical Mechanics** Newton's Laws of Motion, Limitation of Newton's programme; Space-time reference system; Introduction to different coordinate systems-Cartesian, cylindrical and spherical coordinate systems. Mechanics of single particle- Conservation Laws of linear momentum, Angular momentum and mechanical energy, First integrals of motion; Mechanics of a system of particles- Concept of external and internal forces, concept of centre of mass and centre of mass frame of reference, Conservation laws of linear momentum, Angular momentum and mechanical energy, relation between angular momentum and angular momentum about the Centre of Mass.	11
II	**Lagrangian And Hamiltonian Dynamics** Degrees of freedom; Constraints - Their classification, properties and examples; Generalized coordinates, Transformation equations, Generalized Displacement, Velocity, Acceleration, Momentum, Force and Potential; Principle of Virtual Work & D'Alembert's Principle, Lagrange's equations of motion from D'Alembert's Principle; Cyclic or ignorable coordinates; Integrals of motion; Concept of symmetry-Homogeneity and isotropy. Hamilton's Function and Hamilton's equations of motion, Properties of Hamiltonian and Hamilton's equations of motion; Formation of (i) Lagrangian and Lagrange's equations of motion (ii) Hamiltonian and Hamilton's equation of motion-for-Linear Harmonic oscillator, Atwood's machine, simple pendulum & compound pendulum.	12
III	**Motion Under Central Force** Definition and properties of the central force, two body central force problem- reduction to equivalent one body problem (Lagrangian and Lagrange's equations of motion); differential equation for an orbit, general features of the orbit, stability of the orbits under central force and conditions	11

	for closure. Inverse square law- Kepler's law of planetary motion and their derivation; Scattering in central force field- Scattering cross-section, scattering angle, impact parameter and derivation of Rutherford scattering cross-section	
IV	**Rotating Frames and relative Coordinate Systems** Inertial and non-inertial frame of references; inertial forces in rotating frame (rotating coordinate systems) – Coriolis force and derivation of Coriolis force from Lagrangian formulation, electromagnetic analogy of the inertial forces; effect of Coriolis force- on projectile motion (a) the projectile dropped from a height (h) with initial velocity zero (b) the projectile is sent vertically up with velocity $v_o$to reach a height h above the ground and if returns to the ground, river flow on the surface of earth, formation of cyclones, trade and tropical winds, Coriolis force effect in atomic nuclei, Coriolis phenomenon in the planetary atmospheres; Focault pendulum, Precession of charged particles in a magnetic field, methods of handling the situations with two rotations separated by a time varying translation.	11
	<u>Practicum</u> 1. To study the Motion of spring and calculate spring constant &value of Acceleration due to Gravity. 2. To determine the value of 'g' by using Kater's pendulum. 3. To study (i) the law of conservation of linear momentum (ii) the law of conservation of kinetic energy and (iii) to calculate the restitution using one dimensional collision apparatus of two hanging spheres. 4. To investigate the motion of coupled oscillators. 5. Surface tension by Quinke's method 6. Young's modulus by Koenig's method. 7. To determine "Y" by optical lever. 8. Viscosity of liquid using Stokes method. 9. To determine the surface tension of a liquid by jaeger's method. 10. To determine the coefficient of Viscosity by Poiseuille'smethod 11. Verification of parallel & perpendicular axis theorem– using Moment of Inertia. 12. Determination of Log decrement & viscosity. 13. Verification of vibrating string Melde's experiment **Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.**	30
Suggested Evaluation Methods		

Internal Assessment: ➢ **Theory(20Marks)** • Class Participation: **05 Marks** • Seminar/presentation/assignment/quiz/classtestetc.:**05 Marks** • Mid-TermExam:**10 Marks** ➢ **Practicum(10Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam: **Nil**	**End Term Examination :50 Marks** **20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Classical Mechanics, H. Goldstein (2nd Edition)
2. Mechanics, D.S. Mathur, S. Chand & Com. Pt. Ltd., New Delhi
3. Classical Mechanics, J. C. Upadhyaya, Himalya Publishing House, Mumbai.
4. Classical Mechanics, S.L. Gupta, V. Kumar & H.V. Sharma, Pragati Prakashan, Meerut.
5. Classical Mechanics, N. C. Rana & P. S. Joag, Tata McGraw-Hill Publishing company Limted, New Delhi
6. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, NewDelhi
7. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
8. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons,Delhi
9. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
10. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
11. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.

Scheme of Examination for SEC

Semester	Course Type	Course Code	Nomenclature of paper	Credits T+P	Contact hours T+P	Internal marks	End term Marks	Total Marks	Duration of exam (Hrs) T + P
3	SEC-3	24UN-PHY-SEC301	Radiation Safety	2+1	2+2	20	50	70	3

Chaudhary Bansi Lal University Bhiwani Undergraduate Programs

Course: SEC-3

Session:2024-25	
Part A-Introduction	
Subject	Physics
Semester	3rd
Name of the Course	**Radiation Safety**
Course Code	24UN-PHY- SEC301
Course Type: (CC/MCC/MDC/CC-M/DSEC /VOC/DSE/PC/AEC/VAC)	SEC
Level of the course(Asper Annexure-I	100-199
Pre-requisite for the course(if any)	Appeared or passed the 2nd sem. (B.Sc. Physical Science)

Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Have introductory idea about Basic concept of atomic structure and composition of nucleus and its properties. 2. Have the knowledge about the types of Radiation: Alpha, Beta, Gamma and Neutron and their sources. 3. Understand importance of radio isotopes, Nuclear fission and fusion reactions and their hazardous aspects 4. Have the knowledge about the importance of some scientifically and technologically advanced materials. 5. Learn to present observations, results, analysis and different concepts related to experiments nuclear and radiation physics.

Credits	Theory	Practical	Total
	2	1	3
Contact Hours	2	2	4

Max. Marks:70 **Internal Assessment Marks:20** **End Term Exam Marks: 50**	**Time:3 hours**

Part B-Contents of the Course

Instructions for Paper-Setter

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.	8

II	Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, Interaction of Charged Particles: Heavy charged particles Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), Interaction of Neutrons- Collision, slowing down and Moderation	8
III	Radiation detection and monitoring devices: Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose. Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, and Gieger Muller Counter), Scintillation Detectors.	7
IV	Radiation safety management: Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, Application of nuclear techniques: Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Carnera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. Industrial Uses: Tracing, Gauging, Material Modification, Sterization, Food preservation.	7
	Practicum 1. Study the background radiation levels using Radiation meter. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source). 2. Study of counting statistics using background radiation using GM counter. 3. Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage. 4. Study of absorption of beta particles in Aluminum using GM counter. 5. Detection of a particles using reference source & determining its half life using spark counter 6. Gamma spectrum of Gas Light mantle (Source of Thorium) 7. Characteristics of Geiger Muller (GM) Counter: **Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.**	30

Suggested Evaluation Methods	

Internal Assessment:
• **Theory (15 Marks)**
  • Class Participation: **4 Marks**
  • Seminar/presentation/assignment/quiz/classtestetc.:**4 Marks**
  • Mid-TermExam:**7 Marks**
Practicum (5 Marks)
  • Class Participation: **Nil**
  • Seminar/Demonstration/Viva-voce/Lab records etc.: **5 Marks**
  • Mid-Term Exam: **Nil**
	End Term Examination :Marks : 35 Marks
	
	:15 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. W.E. Burcham and M. Jobes- Nuclear and Particle Physics - Longman (1995)
2. G.F.Knoll, Radiation detection and measurements
3. Thermo luninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology". JohnWright and Sons, UK, 1989.
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